Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/167
UNITED KINGDOM
February 1964
Original: ENGLISH

Confidential until official release during Conference

Abstract

NEUTRON INTERACTIONS WITH REACTOR MATERIALS

by

* E. R. Rae

\+ R. Batchelor

* P. A. Egelstaff

* A. T. G. Ferguson

The UKAEA programme of measurements of neutron interactions with fissile, fertile, moderator, coolant and structural materials is briefly discussed in the light of reactor physics demands. The reasons behind the measurements and the extent of the programme are summarised in the first section while the remainder of the paper is devoted to the description of the experimental work on typical examples of each of the categories mentioned, namely uranium-235, uranium-238, iron and water.

The section on uranium-235 describes measurements of the fission cross section in various neutron energy regions from thermal to 14 MeV. The variation of the quantities $\overline{\nu}$ and η with neutron energy is presented, the former over a wide energy range and the latter in the resonance region. A determination of the total cross section up to 80 KeV is also given, from which s and p-wave strength functions and the absorption cross section are deduced.

The work on ^{238}U is illustrated by studies of the capture cross section throughout the energy range from a few eV to 14 MeV and of inelastic scattering from threshold to 4 MeV. Recent improvements in technique permit the construction of much more complete energy level schemes for the ^{238}U nucleus.

Nuclear inelastic scattering in iron is also described in the energy range 1 to 4 MeV and optical model fits are given to the data. Cross sections and spectra for the emission of γ-rays following inelastic scattering are described,

* UKAEA, Atomic Energy Research Establishment, Harwell, Berkshire.

\+ UKAEA, Atomic Weapons Research Establishment, Aldermaston, Berkshire.

and the capture cross section below 100 KeV is briefly discussed.

The final section of the paper deals with the scattering of thermal neutrons by bound nuclei. The results of measurements do not contain the complete information required for reactor calculations and must be supplemented by theoretical considerations based on suitably chosen models of the moderator materials. The data for water at different temperatures are presented and compared with several theoretical models.